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## (54) A motorised vehicle

(57) A four wheel drive vehicle which can negotiate undulating terrain, which is of low overall height and which is highly manoeuvrable has four wheel drive, independent suspensions and four wheel steering. The engine 30 and integral gearbox is disposed

longitudinally and offset with respect to the longitudinal axis of the vehicle and a pair of output drive shafts 38, 44 emerge from the gearbox in the fore and aft directions to provide input to a front and a rear axle differential 36. The arrangement achieves four wheel drive without expensive transfer boxes.

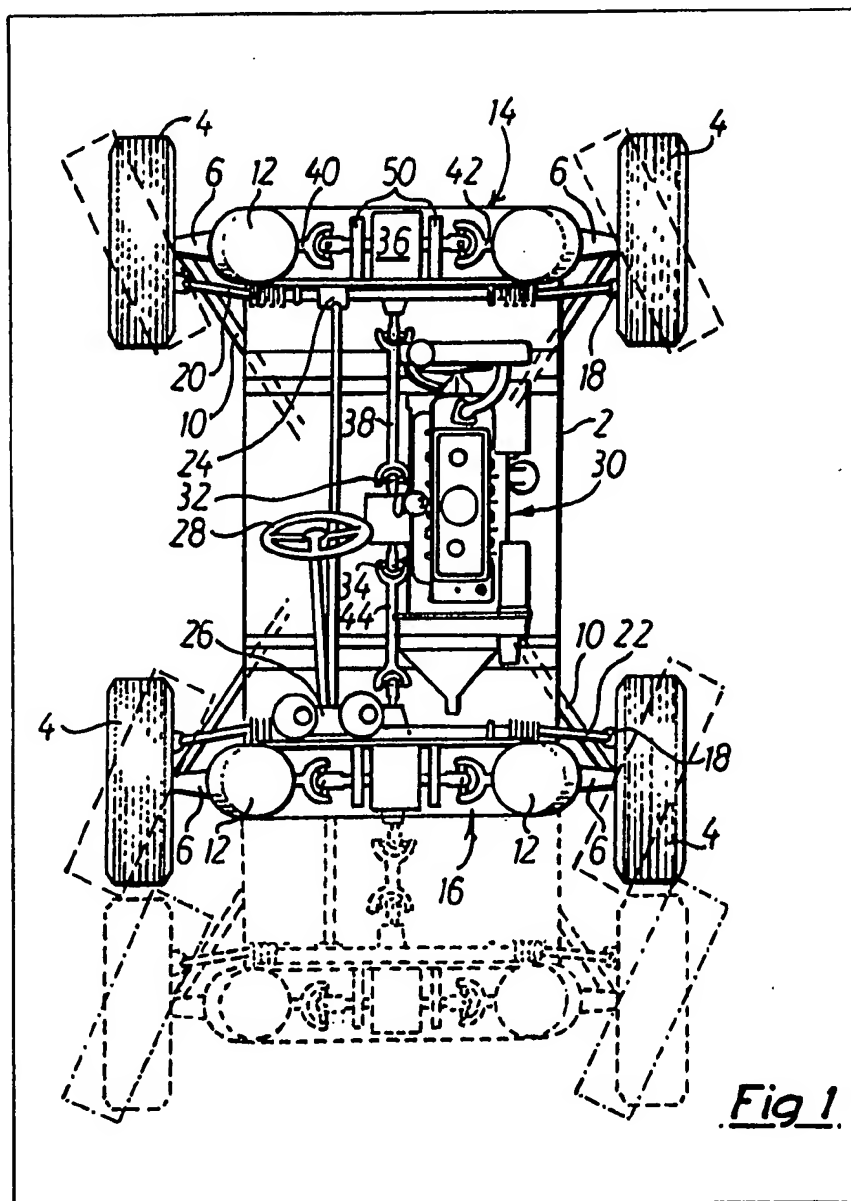


Fig 1

GB 2 081 656 A

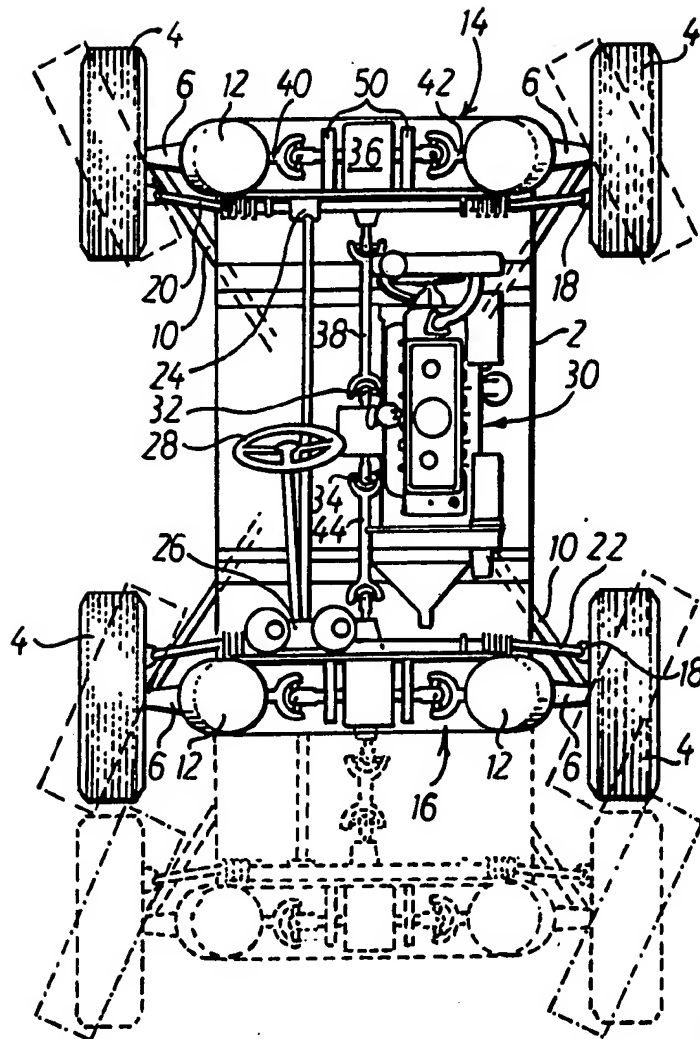


Fig 1.

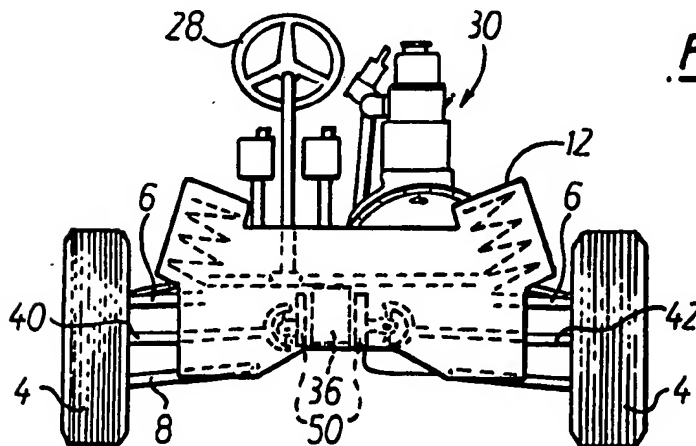


Fig 2.

# SPECIFICATION A motorised vehicle

The present invention relates to a motorised vehicle in particular to four wheel drive vehicles.

5 A known four wheel drive vehicle has a power unit which drives the rear wheels of a rear axle via a gearbox, a propeller shaft, differential and half shafts. Drive to the wheels of the front axle is taken from the rear of the gearbox by way of a  
10 transfer box, propeller shaft, differential and half shafts. The power unit is positioned on the longitudinal axis of the vehicle between the front wheels and it is necessary to have the front differential offset relative to the longitudinal axis  
15 so as to receive the drive from the transfer box. The output shaft from the transfer box is parallel to but offset from the rear/drive shaft. In the known system both the front and the rear axles are solid axles suspended by way of leaf springs.

20 The specialised components used in the known drive system, for example the transfer box and front axle casing with offset front differential, increase the cost of the vehicle.

Heretofore such constructions have resulted in  
25 four wheel drive vehicles which are large and not easily manoeuvrable in tight spaces and which have a large overall height which frequently prevents their use in off road conditions where there may be low hanging tree branches.

30 It is an aim of the present invention to provide a motorised vehicle having four wheel, drive and independent suspensions.

It is a further aim that the vehicle be readily constructed from largely standard parts and that  
35 the vehicle be manoeuvrable and of compact construction.

Yet another aim of the invention is to provide a four wheel drive vehicle which does not require a complicated and expensive transfer gear box.

40 According to the present invention there is provided a motorised vehicle comprising a chassis, at least four wheel groups distributed among a front axle group and at least one rear axle group, each wheel having independent suspension  
45 and being driven from a single power unit disposed longitudinally between the front and rear axle groups and offset with respect to the longitudinal axis of the vehicle, a gear box integral with the power unit and driven thereby and having  
50 two output drive shafts, one drive shaft leading to a differential of the front axle group and the other drive shaft leading to a differential of the rear axle group, each axle group having a steering mechanism, and a steering wheel being provided  
55 to control the input to each steering mechanism so as to simultaneously steer the wheel groups of the front and rear axle groups.

Preferably the output from the gear box drives reduction gearing which in turn drives the two  
60 output drive shafts. Conveniently each wheel group is independently suspended to the chassis of the vehicle by an upper and a lower radius arm which are attached to a wheel hub by way of ball joints. The drive to the respective wheel is by way

65 of a respective half shaft each of which has at its wheel end a constant velocity joint and at its other end a universal joint which is secured to the output from the differential. A spring member preferably a coil spring acts between the frame  
70 and the upper radius arm provide the suspension medium.

The present invention will now be described further, by way of example only, with reference to the accompanying drawings, in which:—

75 Fig. 1 is a somewhat diagrammatic plan view of a vehicle in accordance with the invention, and

Fig. 2 is a front view of the embodiment of Fig. 1.

Referring now to the drawings, the vehicle has  
80 a frame 2 to which is attached all the running gear. In a preferred embodiment the vehicle has four wheels 4 which are distributed among a rear axle group 14 and a front axle group 16 and which are independently suspended with respect to the  
85 frame 2. Each wheel is carried by a hub which is mounted to the frame by way of an upper arm 6, a lower arm 8 and a semi-trailing arm 10. A spring member 12 in the form of a coil spring abuts at one end the frame and at the other end the upper  
90 arm to provide the suspension means. A damper may be provided if required, for example the spring member 12 may comprise a coil spring damper unit.

The upper and lower arms 6, 8 are attached to  
95 the hub by way of swivel joints which permit each wheel to swivel. A steering arm 18 is attached to each wheel and the steering arms of the rear axle group 14 are connected, by way of track rods 20, to a rear steering mechanism 24 and the steering  
100 arms 18 of the front axle group 16 are connected by way of track rods 22 to a front steering mechanism 26. A steering wheel 28 operates both mechanisms simultaneously to provide four wheel steering.

105 A power unit 30, preferably a multi cylinder piston engine, is disposed with its longitudinal axis parallel to but offset from the longitudinal axis of the vehicle and is positioned intermediate between the front and rear axle groups. A gear box  
110 is mounted integrally with the engine and a pair of output drive shafts 32, 34 are driven by the gear box.

The drive is taken from one output drive shaft  
115 32 to a rear differential 36 (which may be lockable) by way of shaft 38 universally jointed at each end. The drive is transmitted from the differential 36 to each rear wheel by way of respective drive shafts 40, 42 having drive  
120 couplings at either end thereof. The outer drive coupling is a constant velocity joint and the inner coupling is in the form of a rubber coupling. The differential is housed in a casing which is attached to the frame by way of bolts and a pair of pillow  
125 blocks 50, which support the output shafts of the differential. The pillow blocks are attached to the frame by way of a mounting plate.

The front drive shaft 44 transmits drive to the front wheels by way of a front differential, front drive shafts and drive couplings in an identical

manner to the drive to the rear wheels.

A braking system is provided which comprises wheel brakes actuated from a foot operated master cylinder.

- 5 In a preferred embodiment the gear box drive is by way of a crown wheel and pinion (incorporating reduction gearing) and a differential.

- 10 In an alternative the vehicle may have additional front and/or rear axle groups; for example an additional front axle group is shown dotted in Fig. 1. The wheels are independently suspended and have suspension components of identical construction to those of the front and/or rear axle. The additional axle may be driven from the differential of the adjacent axle.

#### CLAIMS

1. A motorised vehicle comprising a chassis, at least four wheel groups distributed among a front axle group and at least one rear axle group, each wheel group having independent suspension and being driven from a single power unit disposed longitudinally between the front and rear axle groups and offset with respect to the longitudinal axis of the vehicle, a gear box integral with the power unit and driven thereby and having two output drive shafts, one drive shaft leading to a differential of the front axle group and the other drive shaft leading to a differential of the rear axle group, each axle group having a steering mechanism, and a steering wheel being provided to control the input to each steering mechanism so as to simultaneously steer the wheel groups of the front and rear axle groups.

2. A motorised vehicle as claimed in claim 1, in

- 35 which the output from the gear box drives reduction gearing which in turn drives the two output drive shafts.

3. A motorised vehicle as claimed in claim 1 or 2, in which each wheel group is independently suspended to the chassis of the vehicle by an upper and a lower radius arm which are attached to a wheel hub by way of ball joints.

4. A motorised vehicle as claimed in any preceding claim in which the drive to the respective wheel is by way of a respective half shaft each of which has at its wheel end a constant velocity joint and at its other end a universal joint which is secured to the output from the differential.

- 50 5. A motorised vehicle as claimed in any preceding claim in which a spring member acts between the frame and the upper radius arm to provide the suspension medium.

- 55 6. A motorised vehicle as claimed in claim 5, in which the spring member is a coil spring.

7. A motorised vehicle as claimed in claim 5 or 6, in which each wheel group is provided with a damper.

8. A motorised vehicle as claimed in any preceding claim, in which the wheel groups of the front axle group are turned in the opposite direction to the wheel groups of the rear axle group by the steering mechanism.

9. A motorised vehicle as claimed in claim 1, in which the rear differential is lockable.

- 65 10. A motorised vehicle constructed and arranged and adapted to operate substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.